IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:
Denton et al.

Atty. Docket No.: BUR920040007US1

Serial No.: 10/707,977

Group Art Unit: 3624

Filed: January 29, 2004

Examiner: Mark A. Fleischer

For: A METHOD FOR SUPPLY CHAIN DECOMPOSITION

AMENDMENT UNDER 37 C.F.R. §1.116

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This amendment is in response to the Final Office Action mailed November 18, 2009, setting a three-month statutory period for response. Therefore, this amendment is timely filed.

Please amend the above-identified patent application as follows:

IN THE CLAIMS:

Please substitute the following claims for the same-numbered claims in the application:

1. (Currently Amended) A method for ~~decomposing~~ solving a linear program having material balance and sourcing constraints in a production planning system, said method comprising:

temporarily removing, by a computer system and based on stocking point criteria, selected ones of said material balance and sourcing constraints from said linear program so that said linear program can subsequently be decomposed into smaller linear programs;

decomposing, by said computer system, said linear program into said smaller linear programs;

initially solving, by [[a]] said computer system, ~~said linear program~~ each of said smaller linear programs in parallel and without said selected ones of ~~with~~ said material balance and sourcing constraints to produce an initial solution,

~~wherein, during said initially solving, selected ones of said material balance and sourcing constraints are relaxed based on stocking point criteria,~~

wherein said selected ones of said material balance and sourcing constraints are associated only with the least complex parts within bills of materials used by said linear program,

wherein said least complex parts comprise raw materials and unassembled parts, and

wherein said initial solution identifies values for variables in said linear program; and

finally solving, by said computer system, said linear program ~~using said values identified in said initial solution as said variables and~~ with all of said material balance and sourcing constraints in place ~~such that none of said material balance and sourcing constraints are relaxed~~ in order to obtain a complete solution of said linear program, said finally solving comprising replacing said variables with constants, said constants comprising said values identified in said initial solution.

2-3. (Cancelled).

4. (Previously Presented) The method in claim 1, wherein said selected ones of said material balance and sourcing constraints are associated with parts that have supply availability and lack capacity constraints.

5. (Previously Presented) The method in claim 1, wherein said selected ones of said material balance and sourcing constraints are associated with parts that are available during the planning horizon of said linear program.

6. (Original) The method in claim 5, wherein said planning horizon includes an initial planning horizon, shipping lead time, and manufacturing cycle time.

7. (Currently Amended) The method in claim 1, wherein said stocking point criteria are ~~associated with~~ based on time dependent stocking points comprising part numbers, locations of parts identified by said part numbers, and the time periods when said parts will be available.

8. (Currently Amended) A method for solving a linear program having material balance and sourcing constraints in a production planning system, said method comprising:

identifying, by a computer system and based on stocking point criteria, selected ones of said material balance and sourcing constraints to be temporarily removed from said linear program so that said linear program can subsequently be decomposed into smaller linear programs ~~relaxed,~~

wherein said selected ones of said material balance and sourcing constraints are associated only with the least complex parts within bills-of materials used by said linear program, and

wherein said least complex parts comprise raw materials and unassembled parts;

relaxing said selected ones of said material balance and sourcing constraints of said linear program by resetting upper and lower bounds on said selected ones of said material balance and sourcing constraints;

temporarily removing, by said computer system, said selected ones of said material balance and sourcing constraints from said linear program;

decomposing, by [[a]] said computer system, said linear program into said smaller linear programs;

initially solving, by said computer system, each of said smaller linear programs in parallel and without said selected ones of ~~with~~ said material balance and sourcing constraints to produce an initial solution,

~~wherein, during said initially solving, said selected ones of said material balance and sourcing constraints are relaxed per said relaxing, and~~

wherein said initial solution identifies values for variables in said linear program; and

finally solving, by said computer system, said linear program ~~using said values identified in said initial solution as said variables and~~ with all of said material balance and sourcing constraints in place ~~such that none of said material balance and sourcing constraints are relaxed~~ to obtain a complete solution of said linear program, said finally solving comprising replacing said variables with constants, said constants comprising said values identified in said initial solution.

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9. (Previously Presented) The method in claim 8, wherein said process of initially solving each of said smaller linear programs solves said smaller linear programs simultaneously in parallel.

10. (Cancelled).

11. (Previously Presented) The method in claim 8, wherein said selected ones of said material balance and sourcing constraints are associated with parts that have supply availability and lack capacity constraints.

12. (Previously Presented) The method in claim 8, wherein said selected ones of said material balance and sourcing constraints are associated with parts that are available during the planning horizon of said linear program.

13. (Original) The method in claim 12, wherein said planning horizon includes an initial planning horizon, shipping lead time, and manufacturing cycle time.

14. (Currently Amended) The method in claim 8, wherein said stocking point criteria are ~~associated with~~ based on time dependent stocking points comprising part numbers, locations of parts identified by said part numbers, and the time periods when said parts will be available.

15. (Currently Amended) A method for solving a linear program having material balance and sourcing constraints in a production planning system, said method comprising:

identifying, by a computer system and based on stocking point criteria, selected ones of said material balance and sourcing constraints to be temporarily removed from said linear program so that said linear program can subsequently be decomposed into smaller linear programs, ~~relaxed based on~~ said stocking point criteria ~~that are associated with~~ being based on

~~with~~ time dependent stocking points comprising part numbers, locations of parts identified by said part numbers, and the time periods when said parts will be available,

wherein said selected ones of said material balance and sourcing constraints are associated only with the least complex parts within bills-of materials used by said linear program, and

wherein said least complex parts comprise raw materials and unassembled parts;

~~relaxing~~ temporarily removing, by said computer system, said selected ones of said material balance and sourcing constraints ~~of~~ from said linear program by resetting upper and lower bounds on said selected ones of said material balance and sourcing constraints;

decomposing, by [[a]] said computer system, said linear program into said smaller linear programs;

initially solving, by said computer system, each of said smaller linear programs in parallel and without ~~with~~ said selected ones of said material balance and sourcing constraints to produce an initial solution,

~~wherein, during said initially solving, said selected ones of said material balance and sourcing constraints are relaxed per said relaxing, and~~

wherein said initial solution identifies values for variables in said linear program; and

finally solving, by said computer system, said linear program ~~using said values identified in said initial solution as said variables and~~ with all of said material balance and sourcing constraints in place ~~such that none of said material balance and sourcing constraints are relaxed~~ to obtain a complete solution of said linear program, said finally solving comprising replacing

said variables with constants, said constants comprising said values identified in said initial solution.

16. (Previously Presented) The method in claim 15, wherein said process of initially solving each of said smaller linear programs solves said smaller linear programs simultaneously in parallel.

17. (Cancelled).

18. (Previously Presented) The method in claim 15, wherein said selected ones of said material balance and sourcing constraints are associated with parts that have supply availability and lack capacity constraints.

19. (Currently Amended) The method in claim 15, [[,]] wherein said selected ones of said material balance and sourcing constraints are associated with parts that are available during the planning horizon of said linear program.

20. (Original) The method in claim 19, wherein said planning horizon includes an initial planning horizon, shipping lead time, and manufacturing cycle time.

21. (Currently Amended) A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform a method for solving

a linear program having material balance and sourcing constraints in a production planning system, said method comprising:

identifying, based on stocking point criteria, selected ones of said material balance and sourcing constraints to be ~~relaxed~~ temporarily removed from said linear program so that said linear program can subsequently be decomposed into smaller linear programs,

wherein said selected ones of said material balance and sourcing constraints are associated only with the least complex parts within bills-of materials used by said linear program, and

wherein said least complex parts comprise raw materials and unassembled parts;

~~relaxing~~ temporarily removing said selected ones of said material balance and sourcing constraints ~~of~~ from said linear program by resetting upper and lower bounds on said selected ones of said material balance and sourcing constraints;

decomposing said linear program into said smaller linear programs;

initially solving each of said smaller linear programs with said material balance and sourcing constraints to produce an initial solution,

wherein, during said initially solving, said selected ones of said material balance and sourcing constraints are relaxed per said relaxing, and

wherein said initial solution identifies values for variables in said linear program; and

finally solving said linear program ~~using said values identified in said initial solution as said variables and~~ with all of said material balance and sourcing constraints in place such that none of said material balance and sourcing constraints are relaxed to obtain a complete solution

of said linear program, said finally solving comprising replacing said variables with constants, said constants comprising said values identified in said initial solution.

REMARKS

Claims 1-2, 4-9, 11-16 and 18-21 were previously presented. A limitation similar to that previously presented in dependent claim 2 is amended herein into claim 1. Thus, claim 2 is cancelled and claims 1, 4-9, 11-16 and 18-21 are all the claims pending in the application. Claims 1, 4-9, 11-16 and 18-21 stand rejected on prior art grounds. Additionally, claims 7-8, 14-15 and 21 stand rejected for being indefinite and claims 8-20 stand rejected for being directed towards non-statutory subject matter. Applicants respectfully traverse these rejections based on the following discussion. The following paragraphs are numbered for ease of future reference.

I. The 35 U.S.C. §112, Second Paragraph, Rejection

[0001] Claims 7-8, 14-15 and 21 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. These rejections are traversed as explained below.

[0002] The Office Action indicates that claims 7 and 14 are rejected because the use of the term "associated with" in the context of "said stocking point criteria are associated with ..." is vague. Claims 7 and 14 are amended herein to indicate that "said stocking point are based on...". Support for the amendment is found in the specification, as published, in paragraphs [0073]-[0074], which define what time dependent stocking points are and then further provided examples of various criterion that are based on such time dependent stocking points.

[0003] The Office Action further indicates claims 8 and 15 recite an identifying step without the use of a computer system, whereas the other method steps do use a computer system. Claims 8 and 15 are amended herein to reflect that this identifying step, like the other steps in the

method, is also performed by the computer system. Support for the amendment is found in the specification, as published, in paragraph [0080].

[0004] Finally, the Office Action indicates that the recitation of "said material and balance constraints" in claim 21 lacks antecedent basis. Claim 21 is amended here to overcome this rejection.

[0005] In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw these rejections.

II. The 35 U.S.C. §101 Rejection

[0006] Claims 8-20 stand rejected under 35 U.S.C. §101 because the Office Action asserts that the claimed invention is directed to non-statutory subject matter. These rejections are traversed as explained below. The Office Action notes that in independent claims 8 and 15, the identifying step was not claimed as being performed by the computer system. Claims 8 and 15 are amended herein to reflect that this identifying step, like the other steps in the method, is also performed by the computer system. Thus, the claimed method is tied to another statutory class and, thereby directed to statutory subject matter as required by *In re Bilski*, __ F.3d __ (Fed. Cir. 2008)). Support for the amendment is found in the specification, as published, in paragraph [0080]. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw these rejections.

III. The Prior Art Rejections

[0007] Claims 1, 4-9, 11-16 and 18-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hegde et al. (U.S. Publication No. 2003/0065415), hereinafter referred to as Hegde in view of Eksioglu ("Optimizing Integrated Production, Inventory and Distribution Problems in Supply Chains"), hereinafter referred to as Eksioglu and further in view of Examiner's Official Notice. Applicants respectfully traverse these rejections based on the following discussion.

[0008] The Applicants submit the references alone and/or in combination do not make obvious the following claim limitations of amended independent claim 1 (or the similar claim limitations of amended independent claims 8, 15 and 21): (1) "temporarily removing, by a computer system and based on stocking point criteria, selected ones of said material balance and sourcing constraints from said linear program so that said linear program can subsequently be decomposed into smaller linear programs… wherein said selected ones of said material balance and sourcing constraints are associated only with the least complex parts within bills of materials used by said linear program, wherein said least complex parts comprise raw materials and unassembled parts"; (2) "wherein said initial solution identifies values for variables in said linear program"; and (3) "finally solving said linear program with all of said material balance and sourcing constraints in place such that none of said material balance and sourcing constraints are relaxed to obtain a complete solution of said linear program, said finally solving comprising replacing said variables with constants, said constants comprising said values identified in said initial solution.".

[0009] The present invention provides a method and system for solving a linear program

having constraints in a production planning system. The invention first determines which of the constraints can be temporarily removed from the program in order to allow the linear program to subsequently be decomposed into smaller linear programs. These constraints are selected based on stocking point criteria, which in turn are based on time dependent stocking points that include part numbers, locations of parts identified by the part numbers, and the time periods when the parts will be available. Additionally, the selected constraints are associated only with the least complex parts (i.e., raw materials and unassembled parts) within bills of materials used by the linear program. Once selected, theses constraints are temporarily removed from the selected the linear program (e.g., by resetting upper and lower bounds on the selected constraints) and the linear program is decomposed into multiple smaller linear programs. These smaller linear programs are solved in parallel and without the selected constraints to produce an initial solution, which includes values for variables in the linear program. Subsequently, the linear program is again solved (i.e., resolved). However, this time the linear program is solved using the values previously acquired during the initial solving process as constants in place of the variables and further with all of the constraints in place in order to obtain a complete solution of the linear program.

[0010] Hedge discloses a method and system for allocation of limited manufacturing resources over time to meet customer demand. Per the Summary (see paragraph [0055]), in the Hedge method a bill of materials is separated by manufacturing stages and each manufacturing stage is partitioned in a heuristic processing and a linear programming processing partition. A MRP production plan is calculated for each manufacturing stage using either the heuristic processing or the linear programming processing by moving backwards through the stages with

respect to the BOM. A best-can-do production plan is calculated using either the heuristic processing or the linear programming processing, depending on the partitioning step by moving forward through the sages with respect to the BOM. The MRP production solution information is prepared for passing recursively backward to a next manufacturing stage. Similarly, information is passed forward based on the best-can-do calculating step. The method embodiments also include imploding and exploding (from top to bottom) the BOM.

[0011] More particularly, referring to Figure 8 and the associated text, the method of Hedge includes a pre-processing step, an explosion step, an implosion step and a post-processing step. The pre-processing step includes separating a bill of materials into independent stages. In the explosion step an MRP-type explosion is carried out for each partition of each stage to determine certain requirements and prepare solution information to be passed backwards to the next stage. In the implosion step supply is matched to the requirements computed in the explosion step subject to capacity constraints and information is passed forwards. Once a feasible production plan is generated, post-processing is carried out to create coherent output files and user-friendly reports.

[0012] Paragraphs [0099]-[0100] of Hedge (i.e., the cited portions of Hedge) discuss specifically, the explosion function at a given stage. Specifically, during explosion a heuristic MRP calculation is performed in the heuristic partition of the current stage in order to pass demand attribute information from the top to the bottom of the BOM for the stage. The demand attribute information is passed by mapping each demand against the assets which satisfy it and then passing this information through the BOMs explosions. This allows the demand attribute information of one manufacturing stage to be later passed to subsequent (lower level) stages.

Next, liner programming is performed in the linear programming partition of the current stage again passing information from the top to the bottom of the BOM for the stage.

[0013] Paragraph [0100] further mentions relaxing linear programming inputs, but only with respect to the customer demand date. For example, if the customer demand date has already ready come and gone, it can be relaxed in order to allow the linear programming to behave as if activities can be done in the past (i.e., the linear programming can be run with a time horizon that beings in the past).

[0014] Thus, the only constraint disclosed by Hedge as being relaxed during the linear programming process is the customer demand date. The customer demand date is not a constraint based on stocking point criteria, which in turn are based on time dependent stocking points (i.e., part numbers, locations of parts identified by said part numbers, and the time periods when said parts will be available). Additionally, the customer demand date is necessarily associated with all parts of the BOM and, thereby not a constraint associated only with the least complex parts (i.e., raw materials and unassembled parts) within the BOM, as claimed. Finally, even though Hedge does mention relaxing a constraint (i.e., the customer demand date), nowhere in Hedge does it disclose temporarily doing so that a linear program can subsequently be decomposed into smaller linear programs, as claimed.

[0015] Page 8 of the Office Action further acknowledges that Hedge does not disclose the relaxing (which has been amended to read temporarily removing), initially solving and finally solving process steps, as claimed. Thus, the Office Action cites Eksioglu as disclosing these limitations. The Applicants respectfully disagree.

[0016] Page 8 of the Office Action specifically cites pages 57, 84 and 24 of Eksioglu is

as disclosing the relaxing and initially solving limitations. Page 57 of Eksioglu mentions specifically that if production capacity constraints (i.e., production capacity at a facility in a given time period) are absent, then a commodity problem can be decomposed into multiple commodity problems. Page 84 of Eksioglu simply mentions various different types of constraints (that balance inflow/outflow at a storage facility, that make sure a retailer's demand is satisfied and that relate to production costs), but not in terms of relaxing those constraints. Page 24 of Eksioglu mentions generally replacing constraints in a formula, but not specifically within smaller linear programs decomposed form a larger linear program.

[0017] Thus, Eksioglu discloses that if a certain type of constraints, namely production capacity constraints, are absent from a commodity problem, then the commodity problem can be decomposed. However, Eksioglu does disclose that such production capacity constraints are only temporarily removed. It also does not disclose that such removal is limited to selected constraints based on stocking point criteria, which in turn are based on time dependent stocking points (i.e., part numbers, locations of parts identified by said part numbers, and the time periods when said parts will be available). Additionally, production capacity constraints are necessarily associated with all parts of the BOM and, thereby not constraints associated only with the least complex parts (i.e., raw materials and unassembled parts) within the BOM, as claimed.

[0018] Page 9 of the Office Action further provides that page 105 of Eksioglu discloses "wherein said initial solution identifies values for variables in said linear program" and that pages 100 and 66 of Eksioglu disclose the finally solving limitation. Pages 105-106 of Eksioglu disclose a two-stage process for solving linear programming in a multi-commodity case. The first process is a linear approximation process and the second is an update process. The cited

text on page 10 of Eksioglu refers generally to a formulation for linear programming relaxation. The cited text on page 66 of Eksioglu refers to the idea that solving decomposed linear formulas are easier than the original formula. However, nowhere Eksioglu does it actually disclose that smaller linear programs, the result of decomposition of an original linear program, are solved, that the solution identifies values for variables in the original linear program, or that the original linear formula is then subsequently solved by replacing the variables with constants (those constants being the values identified when the smaller linear programs were solved).

[0019] It should be noted that the Applicants continue to assert that Official Notice has not been properly taken in this case and challenge the factual assertions made by the Examiner on pages 9 and 11 of the Office Action, as discussed below.

[0020] Per MPEP§2144.03, the notice of facts beyond the record which may be taken by the examiner must be "capable of such instant and unquestionable demonstration as to defy dispute". In this case, Official Notice has been taken of facts that are not capable of such instant and unquestionable demonstration as to defy dispute. Thus, the Examiner has cited several articles (namely, Dantzig, Karbuk, Wolf and Wu) as documentary evidence in support of the taking of Official Notice. However, the Applicants submit that none of these cited articles qualify as documentary evidence for the purpose of taking Official Notice. Specifically, MPEP§2144.03 provides as follows: "assertions of technical facts in the areas of esoteric technology or specific knowledge of the prior art must always be supported by citation to some reference work recognized as standard in the pertinent art", citing *In re Ahlert*, 424 F.2d at 1091, 165 USPQ at 420-21. See also *In re Grose*, 592 F.2d 1161, 1167-68, 201 USPQ 57, 63 (CCPA 1979). The Applicants submit that, while the cited articles may be related to the pertinent art,

there has been no showing that they are "recognized as standard in the pertinent art". Since the articles themselves do not provide sufficient documentary evidence of what is standard in the pertinent, any factual assertions made by the Examiner based on these articles generally should not be officially noticed.

[0021] Additionally, MPEP§706.02(j) discusses 35 U.S.C. 103 rejections and provides that **35 U.S.C. §103** authorizes a rejection where, to meet the claim, it is necessary to modify a single reference or to combine it with one or more other references. MPEP§706.02(j) further provides that "Where a reference is relied on to support a rejection, whether or not in a minor capacity, that reference should be positively included in the statement of the rejection", citing *In re Hoch*, 428 F.2d 1341, 1342 n.3 166 USPQ 406, 407 n. 3 (CCPA 1970). MPEP§706.02(j) further provides that the Office Action should set forth: "(A) the relevant teachings of the prior art relied upon, preferably with reference to the relevant column or page number(s) and line number(s) where appropriate, (B) the difference or differences in the claim over the applied reference(s), (C) the proposed modification of the applied reference(s) necessary to arrive at the claimed subject matter, and (D) an explanation >as to< why >the claimed invention would have been obvious to< one of ordinary skill in the art at the time the invention was made", as required by MPEP§706.02(j). Since the cited articles do not provide adequate documentary support for the taking of Official Notice, since the cited articles are not positively included in the statement of rejection, since the cited articles are relied upon in the rejection without reference to the relevant column or page number(s) and line number(s), and since the Office Action acknowledges that the Hedge and Eksioglu references do not disclose all of the claim limitations in the independent claims, the Applicants submit that a prima facie case for rejecting claims 1, 4-

9, 11-16 and 18-21 under 35 U.S.C. §103(a) has not has not been established.

[0022] Therefore, the Applicants submit that amended independent claims 1, 8, 15 and 21 are patentable over the cited prior art references and the Official Notice taken. Furthermore, dependent claims 4-7, 9, 11-14, 16 and 18-20 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

IV. Formal Matters and Conclusion

With respect to the rejections to the claims, the claims have been amended, above, to overcome these rejections. In view of the foregoing, Applicants submit that claims 1, 4-9, 11-16 and 18-21, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. Therefore, the Examiner is respectfully requested to reconsider and withdraw the rejections to the claims and further to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary.

Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0456.

Respectfully submitted,

Dated: January 15, 2010

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